Single thread Scheduler

All processes called once each sample

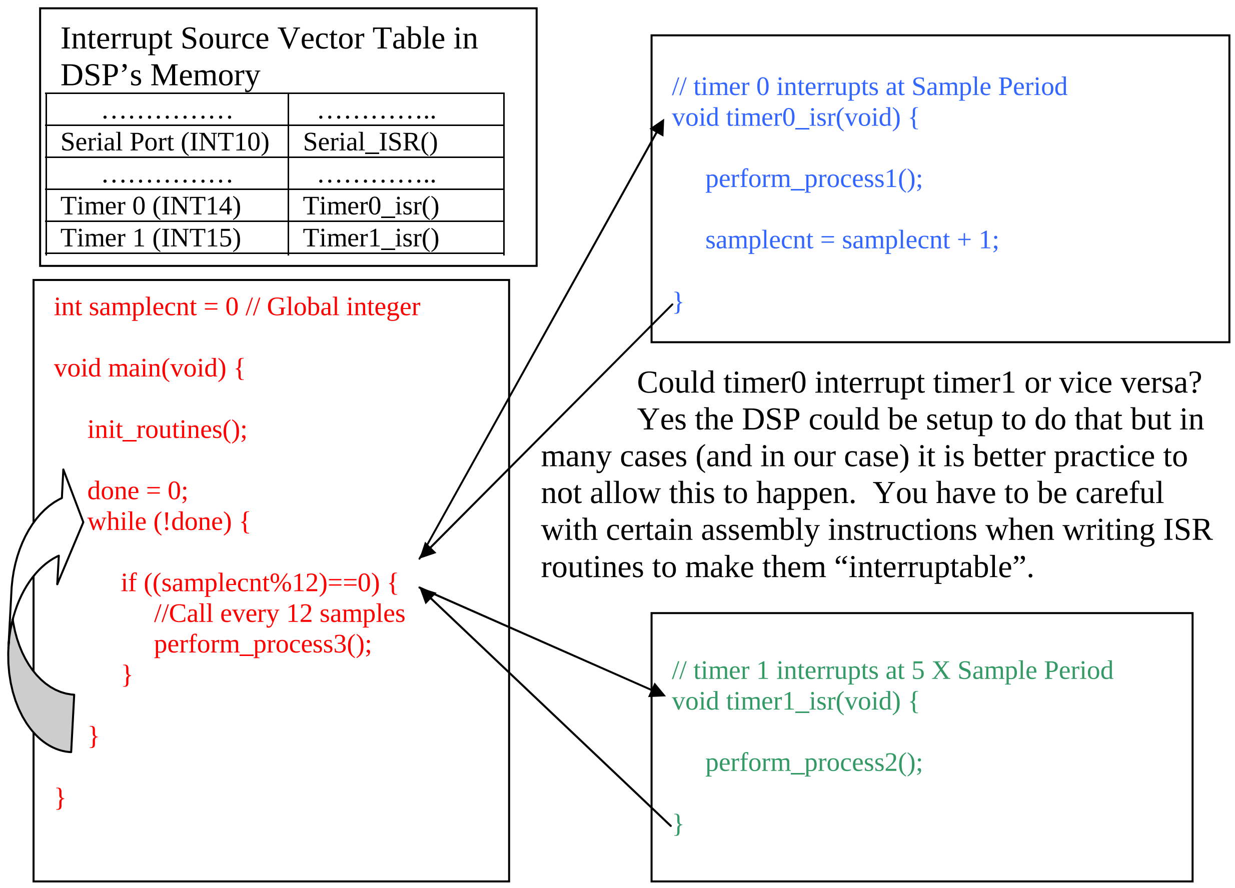
```
void main(void) {

        init_routines();

        done = 0;
        while (!done) {

                perform_process1(); // Highest priority process
                perform_process2();
                perform_process3();// Lowest priority

                wait_for_sample_period();  //waste time here waiting for sample period to expire
        }
}
```

What if the three processes have different sample rates? With a single thread scheduler the following would work but all sample rates would have to be a multiple of the fastest rate.

```
void main(void) {
        init_routines();
        done = 0;
        samplecnt = 0
        while (!done) {

                perform_process1(); // Call every sample

                if ((samplecnt%5)==0) perform_process2();  // Call every 5 samples

                if ((samplecnt%12)==0) perform_process3(); // Call every 12 samples

                wait_for_sample_period();  //waste time here waiting for sample period to expire
                samplecnt = samplecnt+1;
        }
}
```

Here the problem becomes that all processes (in this case all three) need to complete in the time of one sample period. For example at samplecnt = 60 all three processes are called during a single sample period. What if process 3 takes longer than a single sample rate?

Hardware Interrupt Scheduler



Interrupt Source Vector Table in DSP's Memory

……………	…………..
Serial Port (INT10)	Serial_ISR()
……………	…………..
Timer 0 (INT14)	Timer0_isr()
Timer 1 (INT15)	Timer1_isr()

```
int samplecnt = 0 // Global integer

void main(void) {

    init_routines();

    done = 0;
    while (!done) {

        if ((samplecnt%12)==0) {
            //Call every 12 samples
            perform_process3();
        }

    }

}
```

```
// timer 0 interrupts at Sample Period
void timer0_isr(void) {

    perform_process1();

    samplecnt = samplecnt + 1;

}
```

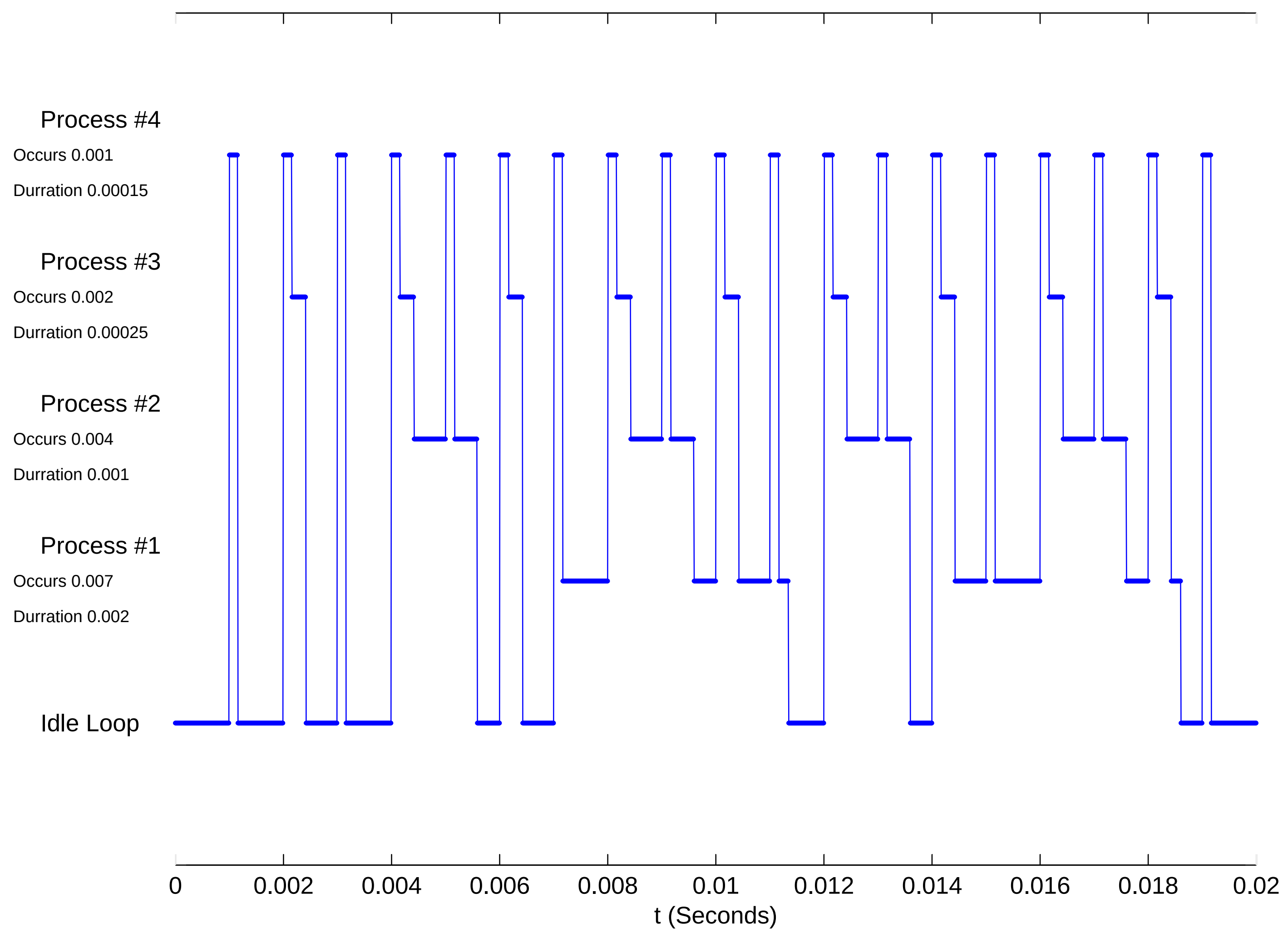
```
// timer 1 interrupts at 5 X Sample Period
void timer1_isr(void) {

    perform_process2();

}
```

Could timer0 interrupt timer1 or vice versa? Yes the DSP could be setup to do that but in many cases (and in our case) it is better practice to not allow this to happen. You have to be careful with certain assembly instructions when writing ISR routines to make them "interruptable".

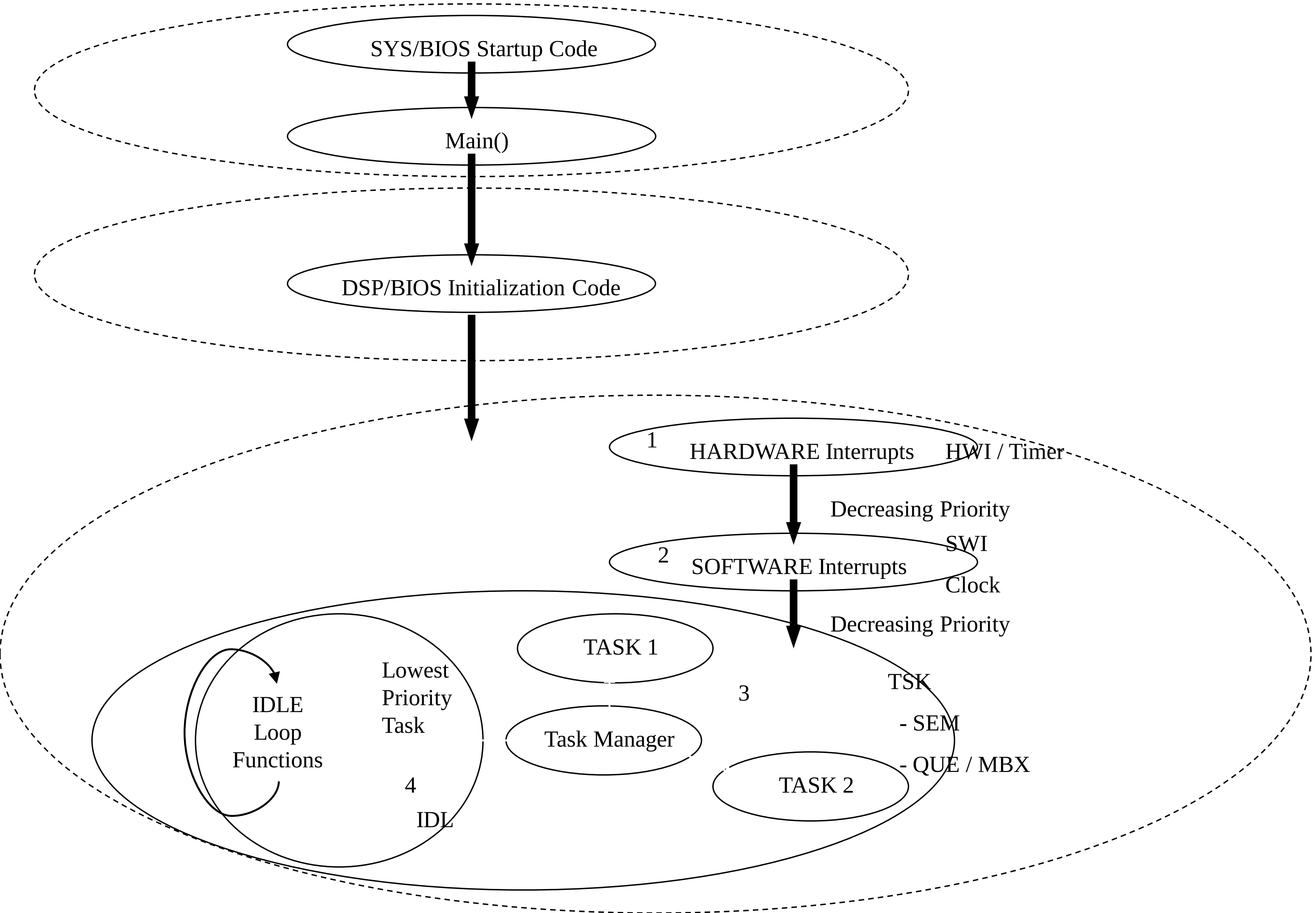
The while loop inside main() now becomes the low priority processing loop. Also called the "background" loop. Process 1 and Process 2 have the highest priority. When either timer 0 or timer 1 counts down to 0, the DSP's hardware automatically stops the current code running in the background loop and jumps to the function specified in the Interrupt Vector Table, in this case timer0_isr() or timer1_isr(). When the DSP is done running the instructions in the corresponding interrupt service routine (ISR), the DSP's hardware automatically returns and continues processing where it left off in the background loop.

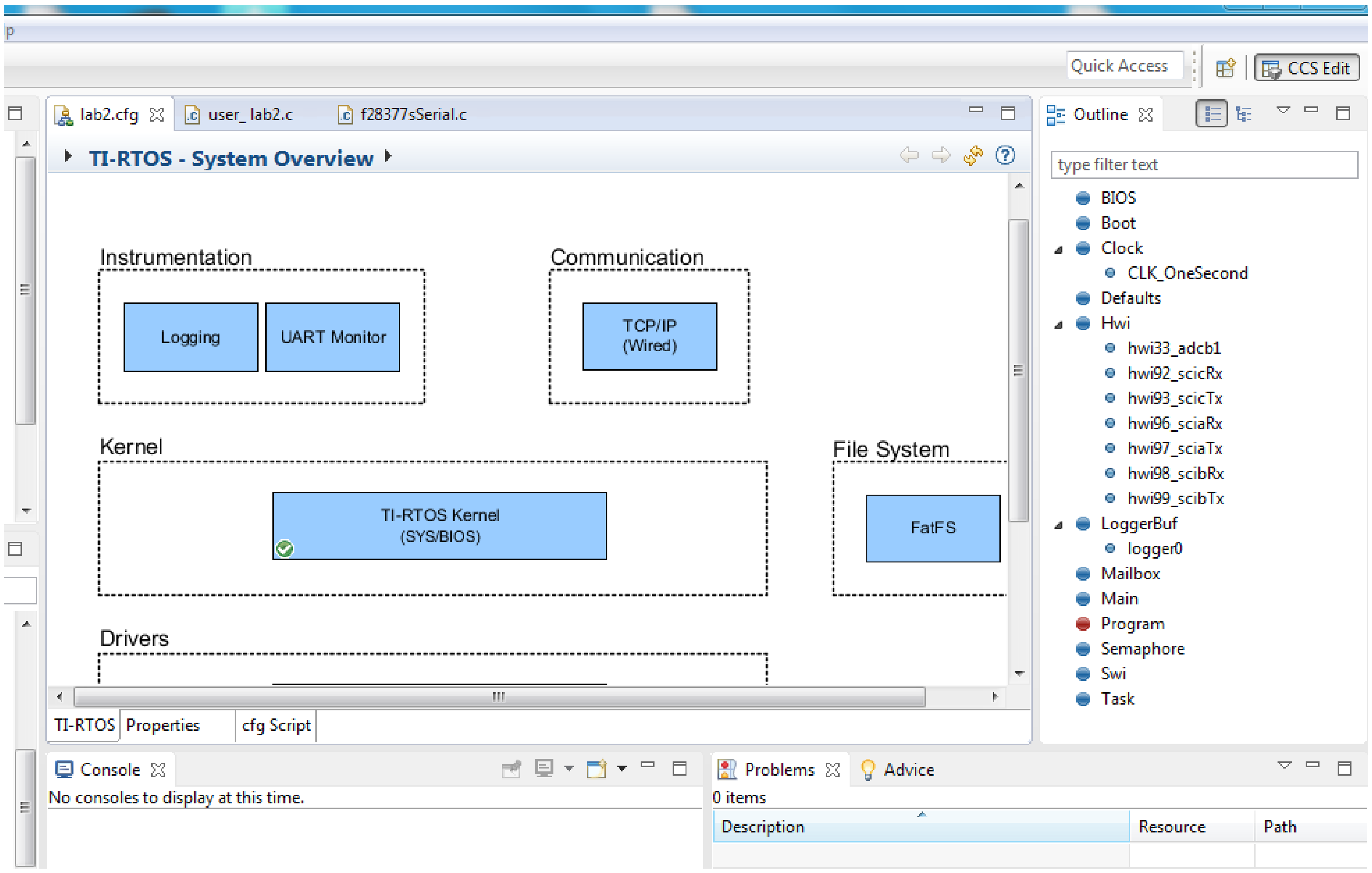
If timer 0 and timer 1 timeout at exactly the same time, timer 0 has the highest priority so its code will run first to completion and then timer 1's code will be executed. If a timer interrupt occurs while the other timer's interrupt service routine code is running, the running code continues to completion and then the other timer's code is executed.

Time Load Graph



SYS/BIOS

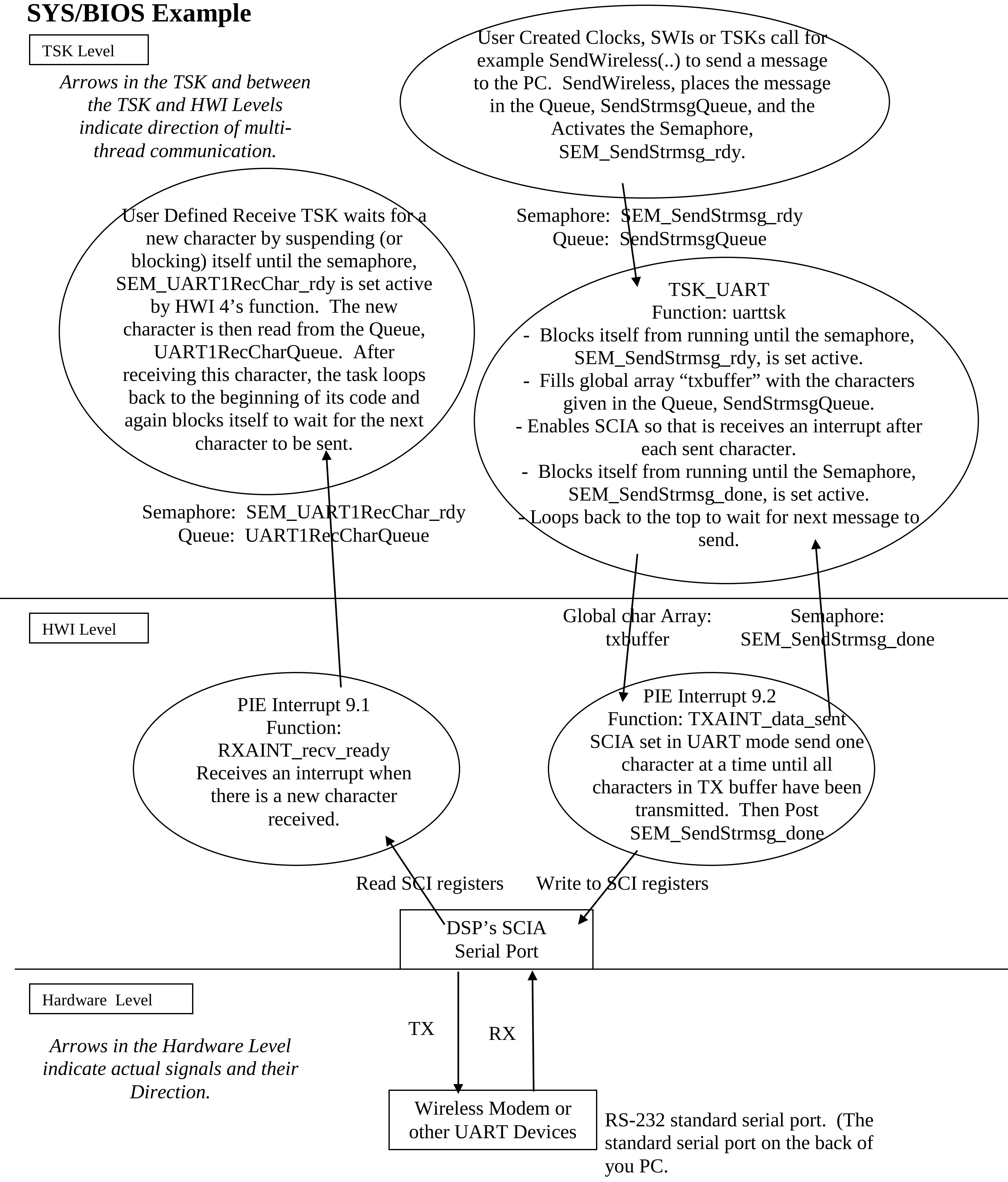

SYS/BIOS Startup Code
Main()
DSP/BIOS Initialization Code
1
HARDWARE Interrupts
HWI / Timer
Decreasing Priority
SWI
2
SOFTWARE Interrupts
Clock
Decreasing Priority
TASK 1
Lowest Priority Task
IDLE Loop Functions
3
TSK
- SEM
Task Manager
- QUE / MBX
TASK 2
4
IDL



```
No consoles to display at this time.
```

```
0 items
```

SYS/BIOS Example



TSK Level

Arrows in the TSK and between the TSK and HWI Levels indicate direction of multi-thread communication.

User Created Clocks, SWIs or TSKs call for example SendWireless(..) to send a message to the PC. SendWireless, places the message in the Queue, SendStrmsgQueue, and the Activates the Semaphore, SEM_SendStrmsg_rdy.

Semaphore: SEM_SendStrmsg_rdy
Queue: SendStrmsgQueue

User Defined Receive TSK waits for a new character by suspending (or blocking) itself until the semaphore, SEM_UART1RecChar_rdy is set active by HWI 4’s function. The new character is then read from the Queue, UART1RecCharQueue. After receiving this character, the task loops back to the beginning of its code and again blocks itself to wait for the next character to be sent.

TSK_UART
Function: uarttsk
- Blocks itself from running until the semaphore, SEM_SendStrmsg_rdy, is set active.
- Fills global array “txbuffer” with the characters given in the Queue, SendStrmsgQueue.
- Enables SCIA so that is receives an interrupt after each sent character.
- Blocks itself from running until the Semaphore, SEM_SendStrmsg_done, is set active.
- Loops back to the top to wait for next message to send.

Semaphore: SEM_UART1RecChar_rdy
Queue: UART1RecCharQueue

HWI Level

Global char Array:
txbuffer

Semaphore:
SEM_SendStrmsg_done

PIE Interrupt 9.1
Function:
RXAINT_recv_ready
Receives an interrupt when there is a new character received.

PIE Interrupt 9.2
Function: TXAINT_data_sent
SCIA set in UART mode send one character at a time until all characters in TX buffer have been transmitted. Then Post SEM_SendStrmsg_done

Read SCI registers

Write to SCI registers

DSP’s SCIA
Serial Port

Hardware Level

Arrows in the Hardware Level indicate actual signals and their Direction.

Wireless Modem or other UART Devices

RS-232 standard serial port. (The standard serial port on the back of you PC.